1984 AIR QUALITY
DATA SUMMARY

REGIONAL MUNICIPALITY OF WATERLOO
AND THE
COUNTIES OF BRANT AND WELLINGTON

November, 1985

Ministry of the Environment

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Air Quality Assessment
Technical Support Section
West Central Region
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INTRODUCTION

This report summarizes the results of air monitoring in the Regional Municipality of Waterloo and the Counties of Brant and Wellington in 1984.

The Ministry of the Environment's West Central Region has conducted routine monitoring in the area since the early 1970's. The Air Management Program in Ontario is based on controlling man-made emissions to meet ambient air quality objectives, which in turn are based on known effects on health, quality of life or sensitive vegetation, whichever is most stringent. To achieve these objectives, sources of pollution are identified, their emissions evaluated and appropriate control measures are instituted. Ambient air monitoring is used to identify pollution sources, evaluate the need for controls and then determine whether controls have been successful.

In addition to monitoring specific industrial sources, monitoring of a more general nature is also carried out in various localities to ensure that air quality objectives are being met and to observe trends in air pollution.

MONITORING NETWORK

The Ministry of the Environment's West Central Region operates a network of monitors in the area in Ayr, Brantford, Breslau, Guelph and Kitchener. Most of the monitoring is performed near industrial sources, in many cases, as a response to local complaints. Monitoring of a more general nature is also carried out at single stations in Guelph and Kitchener to characterize air quality in larger population centres.

Meteorological data (wind speed and direction) are not measured by the Ministry in the area, however, data measured by the University of Guelph at their Elora research station is provided to the Ministry for data analysis. This latter station's wind data was utilized in a computer program known as a "pollution rose" - essentially cross-tabulation of average hourly pollutant concentrations with wind direction classes. The data from this program are illustrated on various maps in this report and are a useful tool in determining the impact on any given source on a monitoring station. The length of each line of the "rose" is proportional to the average yearly concentration when the wind was blowing from that direction. The arrows of the rose point towards the source of the pollutants. The actual concentration values are shown on the maps.

POLLUTANTS MONITORED

Two basic types of air pollutants are measured-gases and particulates (dust).

a) Gases measured with continuous analyzers include:

- Sulphur Dioxide (SO_2) - monitored in Guelph and Kitchener for general ambient levels. SO_2 is a product of fuel combustion. Air quality criteria and their underlying limiting factors are:

  1-hour average - .25 ppm (vegetation effects)
  24-hour average - .10 ppm (health effects in conjunction with particulates)
  1-year average - .02 ppm (vegetation effects)

- Carbon-Monoxide-(CO) - general ambient levels are measured in Kitchener. The major source of CO is the automobile. Criteria for CO are:

  1-hour average - 30 ppm (health effects)
  8-hour average - 13 ppm (health effects)

- Ozone (O_3) - measured in Kitchener to check general ambient levels. Oxidants are products of photochemical reactions involving oxides of nitrogen, hydrocarbons and sunlight and ozone accounts for most of the oxidants produced. The sources of the precursor pollutants are mainly industrial and automotive. Concentrations follow very definite annual and daily trends with highest levels occurring during the summer, and daily maxima usually occurring in mid-afternoon. Both patterns are directly related to temperature and the amount and intensity of sunlight. Ozone and its precursors can be transported over great distances and can be augmented by local sources. Most of the high levels measured in Southern Ontario each summer arrive from the United States. An objective for ozone is:

  1-hour average - 80 ppb (vegetation effects)

- Oxides of Nitrogen - general ambient levels were measured in Kitchener. They are a product of high temperature combustion sources including the automobile. The most abundant oxides are nitric oxide (NO) and nitrogen dioxide (NO_2). Criteria exist only for NO_2:

  1-hour average - .20 ppm (odour)
  24-hour average - .10 ppm (health effects)

b) Particulates (dust) are measured by three methods, each relating to a different size range of particles.

- Dustfall - heavy material generally greater than 10 microns in size (one micron is one-millionth of a metre) that settles out of the atmosphere by gravity.

A plastic container is exposed for one month and the collected dust is weighed and expressed as a deposition rate of grams/square metre/30 days. The measurement is imprecise and observations are restricted to relatively local areas. Criteria are:

1-month average	- 7.0 g/m^2/30 days	(nuisance effects)
1-year average	- 4.5 g/m^2/30 days	(nuisance) effects)

- Total Suspended Particulates (TSP) - measured with high volume (hi-vol) samplers near industrial sources and for general ambient observations. The particles range from submicron to about 50 microns in size. The hi-vol sampler draws air through a glass fibre filter for a 24 hour period. The exposed filter is weighed and the weight of solids collected is converted to an equivalent concentration in air. Units used are micrograms per cubic metre. The samplers run once every six days. Criteria based on health effects in conjunction with sulphur dioxide are:

24-hour average	- 120 ug/m^3	(health effects)
1-year geometric mean	- 60 ug/m^3	(health effects)

- Soiling Index (Coefficient of Haze) - measured by tape samplers which measure fine particles less than 10 microns. COH tape samplers were not used in the Waterloo, Brant or Wellington areas in 1984 but will be in the future. Industrial sources as well as general ambient air are monitored. Coefficient of haze tape samplers determine hourly soiling values. Air is drawn through a filter paper tape for one

hour. A beam of light is shone through the paper before and after the airborne particles are collected. The difference in light transmission is translated into a coefficient of haze (COH) unit. The paper tape then advances and a new hourly sample is taken. The criteria shown below are based largely on correlations with total suspended particulate (TSP):

24-hour average - 1.0 COH's/100 linear feet of air
1 year average - .5 " " " " " " "

DATA ANALYSIS

Ayr

Dustfall was measured near the Date Industries Foundry at station 26026 on Stanley St. (Figure 1) and remained extremely high year-round, well above objectives except for one month as shown in Table 6. Major emissions from this foundry's cupola will have to be controlled. The company will be requested to submit an abatement action plan which may form the basis of a Control Order.

Brantford

Dustfall near the Massey Ferguson Foundry (Figure 2) measured at stations 21010 on Ruth Street and 21011 on Harriet Street remained unchanged from previous years. Levels were low and below objectives for most of the year with the exception of the spring. During the March to June period, the two stations showed all of their exceedences - four at 21010 and two at 21011 (Table 6). Both stations peaked in April and this may been due to a severe windstorm on April 30 which caused elevated particulate levels throughout the Region. Levels were only moderately higher at station 21010 which lies only 75 metres from the plant than at 21011 which is 500 metres away. Due to the relatively low levels measured, no abatement actions are planned but the company will continue to be monitored.

Dustfall near Witco Chemicals at station 21013 on Henry Street (Figure 2) also showed levels similar to previous years with only occasional elevated readings (Table 6). Three samples exceeded the monthly objective, the highest of which occurred in April, probably due to the windstorm. As the station has not revealed a definite problem, no abatement actions are planned but the company will continue to be monitored.

Dustfall near Bell City Foundry at station 21016 on West St. (Figure 2) showed similar levels to previous years (Table 6). The April, May and June samples were marginally excessive, but levels during the rest of the year met the objective. No abatement actions are planned.

Breslau

Dustfall near Breslube measured at station 26036 on Fountain Road (Figure 3) deteriorated somewhat from previous years (Table 4) and the monthly objective was exceeded in 9 out of 12 samples. Interestingly, the April reading was not one of them. The windstorm did not create an air quality problem here. The greatest potential source of dust at Breslube are storage piles of lime. Each month, eight to nine truckloads of lime are deposited and under certain weather conditions, the dust can blow off to neighbouring properties.

Consequently, the samples were analyzed for calcium and lower concentrations were found than in 1983. However, the calcium levels correlated fairly well with the total loading data indicating Breslube's influence on the readings. No immediate abatement actions are planned but better control of these piles may be necessary in the future.

In September/October, in the Ministry's Air Resources Branch conducted a three-week post-abatement survey of Breslube with a mobile air monitoring van to confirm compliance with the Ministry's Control Order.

Concentrations of sulphur dioxide, total reduced sulphurs, oxides of nitrogen, ozone and specific organic compounds met all guidelines, standards or objectives. Levels were lower during this survey than a similar one done in 1983. Process emissions would appear to be now under control, barring upset

conditions. It should be noted that these upsets do occur occasionally, and cause odour problems in the vicinity of the plant. Attempts are being made to minimize these problems.

Guelph

Sulphur dioxide measured downtown at station 28025 at Farquhar and Wyndham (Figure 4) continued to record mostly very low levels and all objectives were met (Table 1). The pollution rose in Figure 6 indicates highest average concentrations arrived from the southeast. All of the higher concentrations occurred during January to March and probably related to space heating. The University of Guelph campus located 1500 metres to the southeast was the likely source of these concentrations.

Suspended particulate concentrations measured at 28025 were also very low year-round, similar to levels in rural areas (Table 5). There was only one sample which exceeded the daily objective on April 30 during the severe windstorm mentioned.

Suspended particulate concentrations measured near Dolime at station 28027 at the sewage treatment plant on Waterloo Ave. (Figure 4) deteriorated from 1983. The yearly objective was marginally exceeded and nine samples exceeded the daily objective, some by a large margin (Table 5). Correlation of the data with wind direction indicated fairly strong correlationships with east and southeast winds, ie., from Dolime. The source of particulate emissions at Dolime are their lime kilns. A Control Order on Dolime will be served in early 1986. The timing of the Control Order requires that controls be installed by May 31, 1987.

Kitchener

The main monitoring station 26029 at Edna and Frederick (Figure 5) continued to show acceptable levels of sulphur dioxide, carbon monoxide and nitrogen dioxide meeting all criteria (Tables 1, 3 and 4).

Ozone concentrations (Table 2) improved somewhat from 1983 with only 6 hours above the hourly objective compared to 57 hours in 1983. This trend was common in the Region and was probably due to a cooler summer.

Pollution roses are presented in Figures 7 to 10 and with the exception of ozone, all peaks occurs under northeast, east and southeast winds - from the adjacent Conestoga Parkway.

The rose for ozone (Figure 10) peaks under southwest winds. Ozone is mainly a photochemical product of long range transport of precursor pollutants (hydrocarbons and oxides of nitrogen) from the United States.

Suspended particulates measured at 26029 increased marginally from 1983 but the yearly objective was not exceeded and there were only three samples above the daily objective (Table 5). One of these was on April 30 due to the windstorm and the other two occurred in November and December for which no Elora wind data is available. Auto emissions from the Parkway were likely responsible, however.

Dustfall was monitored at Station 26040 on Guelph Avenue (Figure 5) near Hogg Fuel and Supply - a cement manufacturer. Elevated concentrations above the objective were found in 6 out of the 11 samples, similar to 1983 (Table 6), however, microscopic analyses of the dust have shown little evidence

of cement plant materials. The samples were composed usually of road dust or biological materials. Although the company does not appear to be the major source of the sampled material, the company will be installing a baghouse in 1986 to further improve their emission control system.

DISCUSSION

This report has summarized the results of routine air monitoring in the Brant, Waterloo and Wellington areas. Where local industrial air pollution problems have been identified, the sources involved will be compelled to reduce their emissions by Control Orders. Other industrial sources monitored show little evidence of problem emissions but will continue to be be carefully monitored.

General air quality as characterized by our stations in downtown Guelph and Kitchener was quite acceptable.

In the near future, (a timetable has not yet been set) a new air quality data telemetry system is to be installed throughout the Province. This new system will permit all of our stations with continuous analyzers to send data directly to our central computer facility in Toronto, allowing for data collection on a real-time basis. Currently, none of the stations in Brant, Waterloo and Wellington areas are telemetered to Toronto. Both current stations in Guelph and Kitchener with continuous analyzers, require manual reading of strip charts for the data. This chart reading process causes delays in the availability of our data, amounting to several months. The new system will allow for immediate access to data as it occurs, both in the Regional Office in Hamilton and in Toronto and will also allow for remote control and maintenance of the instruments. As well, a meteorological tower will be installed, likely in Kitchener, providing wind and temperature data continuously for the area. All of this will result in a more efficient monitoring program.

Once the new system has been implemented, a new expanded Air Quality Index (AQI) will be added to of the current API which refers to only two pollutants. The new AQI will be a function of six different pollutants, which will form up to 8 separate subindices. Concentrations of sulphur dioxide, soiling index, carbon monoxide, nitrogen dioxide, total reduced sulphur and ozone will all be individually converted to the current scale of index numbers with the same advisory or alert levels as the current API, ie., 32, 50, 75 and 100. Not all stations will measure all of the parameters, but the highest subindex and the pollutant causing it will be reported several times daily to the public. In the Brant, Waterloo, Wellington area, the new AQI's will be reported for the existing Kitchener station and a new Guelph station, as well as a new station in downtown Waterloo. The potential for additional communities reporting AQI's is possible in the future. We hope that the new index will better inform the people of Ontario about air quality.

FIGURE 1

Air Monitoring Station-Ayr

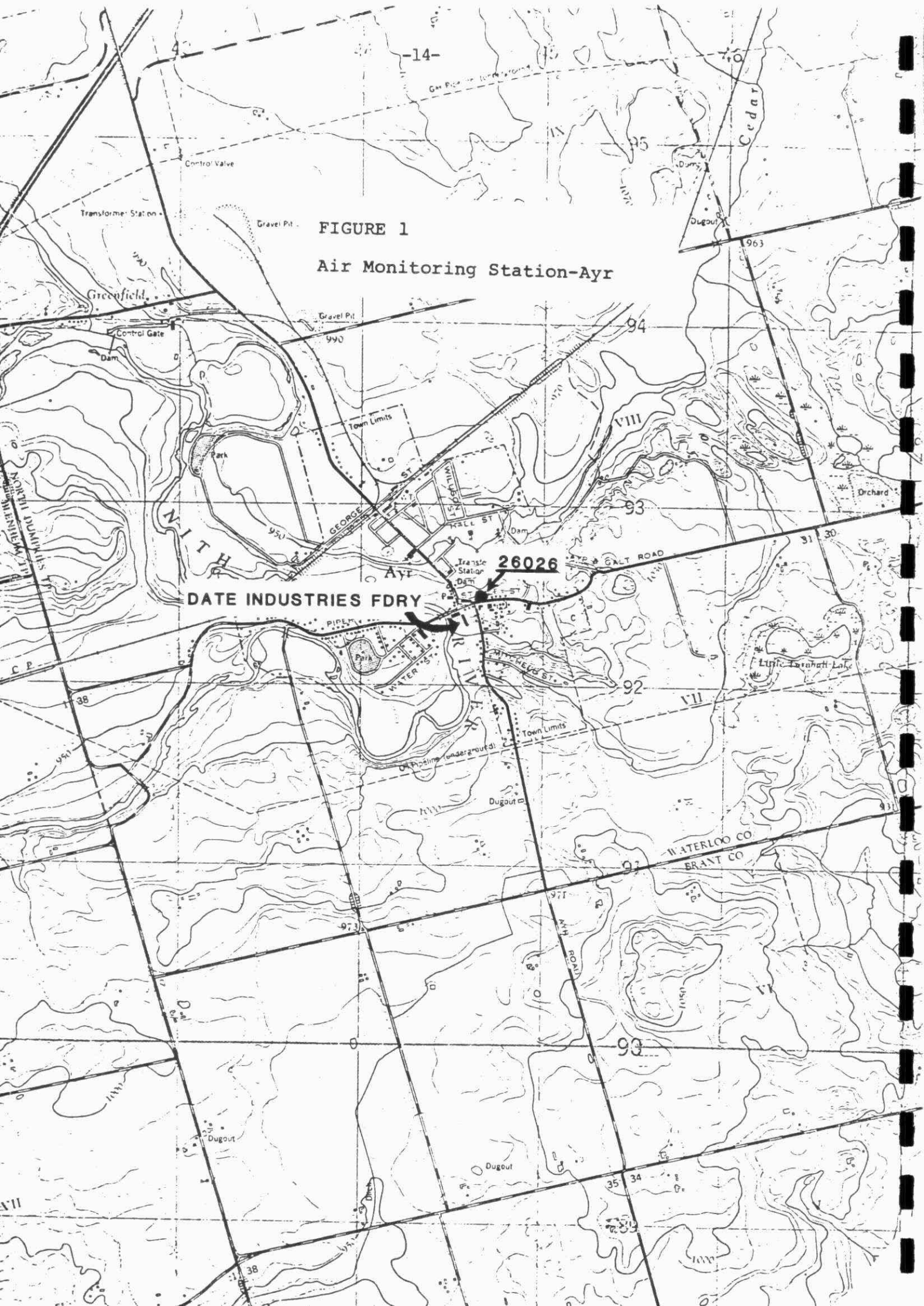


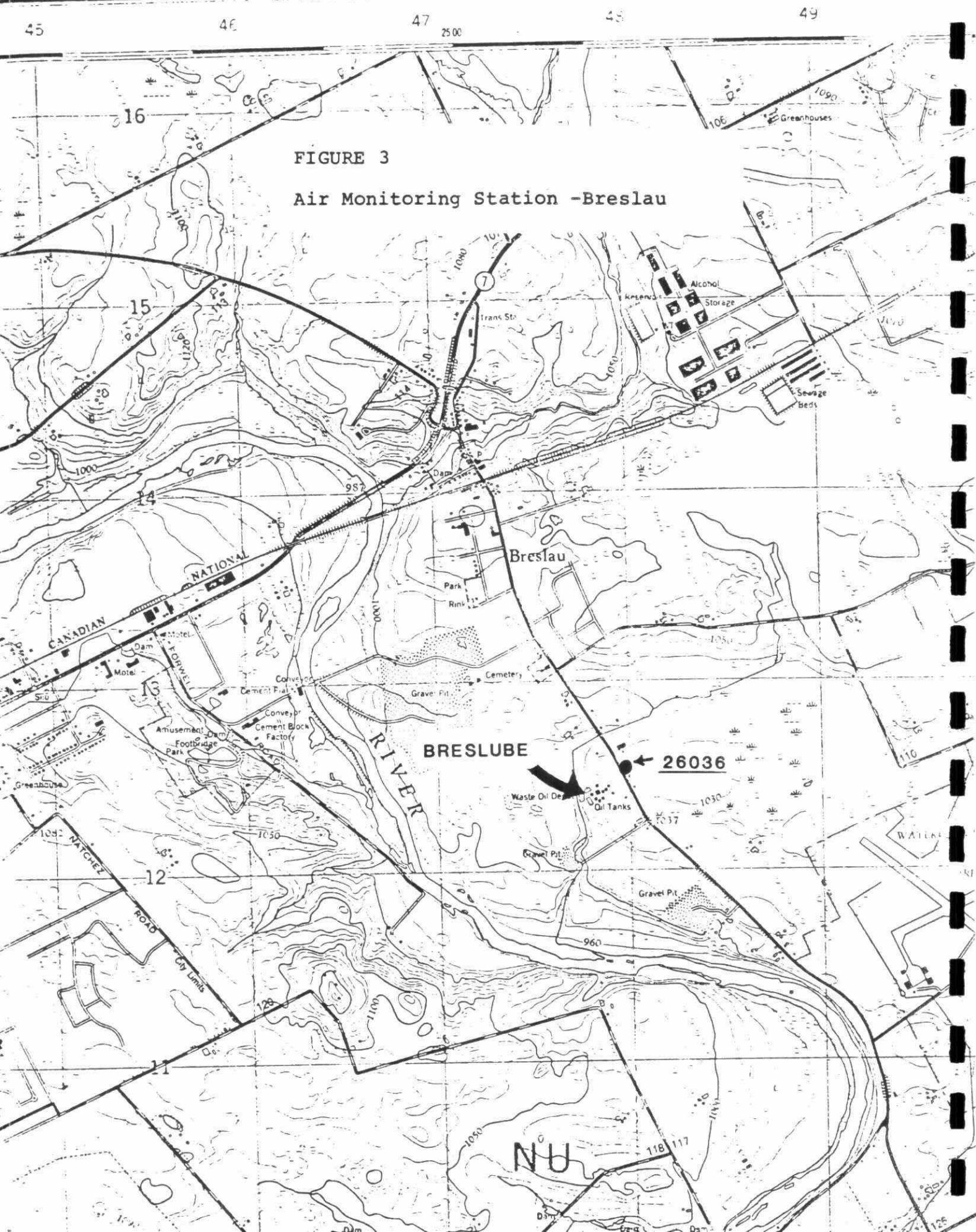
FIGURE 2

Air Monitoring Stations-Brantford

CANADA EDITION 1

FIGURE 3

Air Monitoring Station -Breslau



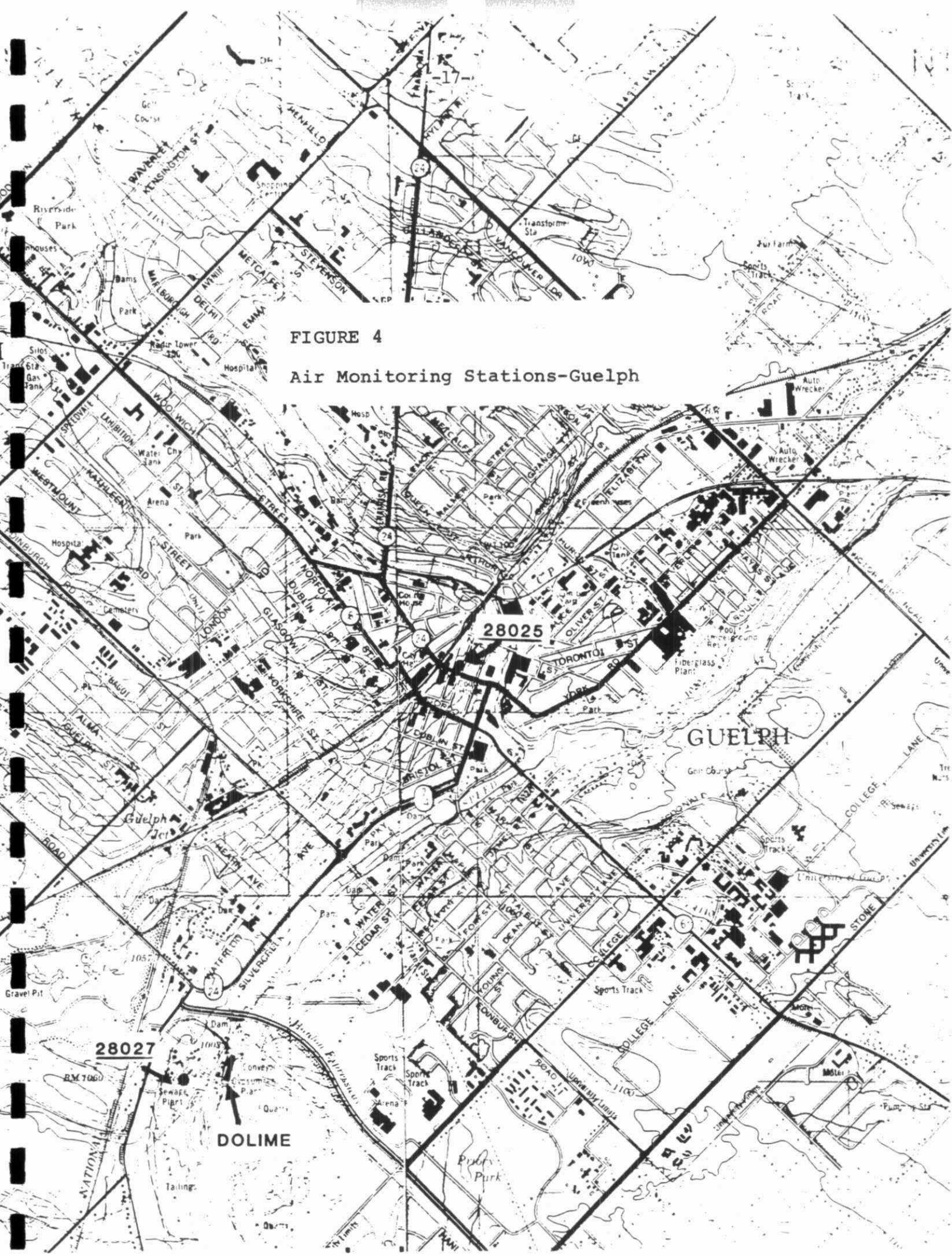


FIGURE 4

Air Monitoring Stations-Guelph

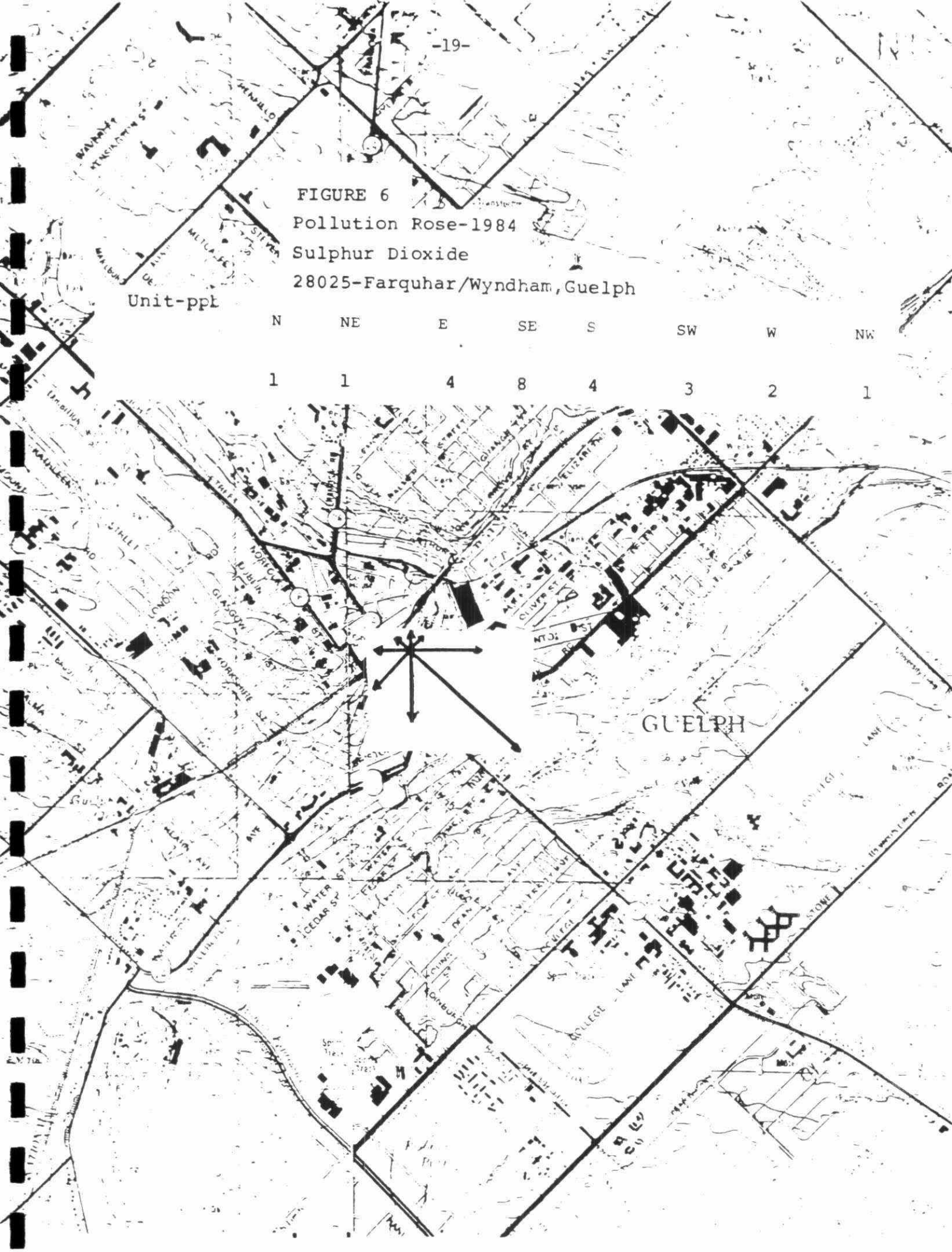
FIGURE 5

Air Monitoring Stations-Kitchener

FIGURE 6
Pollution Rose-1984
Sulphur Dioxide
28025-Farquhar/Wyndham,Guelph

Unit-ppb

N	NE	E	SE	S	SW	W	NW
1	1	4	8	4	3	2	1



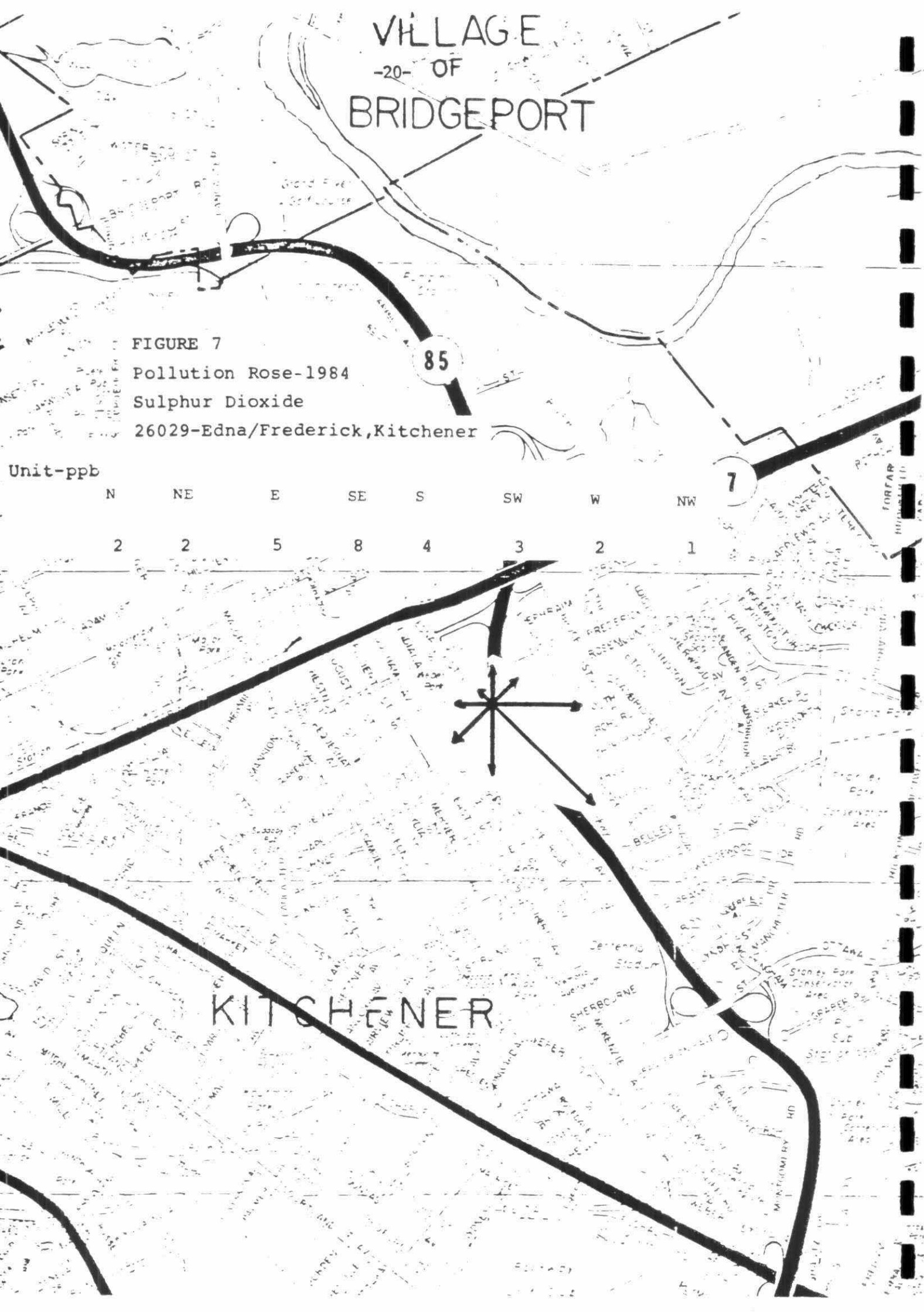


FIGURE 7
Pollution Rose-1984
Sulphur Dioxide
26029-Edna/Frederick,Kitchener

Unit-ppb

N	NE	E	SE	S	SW	W	NW
2	2	5	8	4	3	2	1

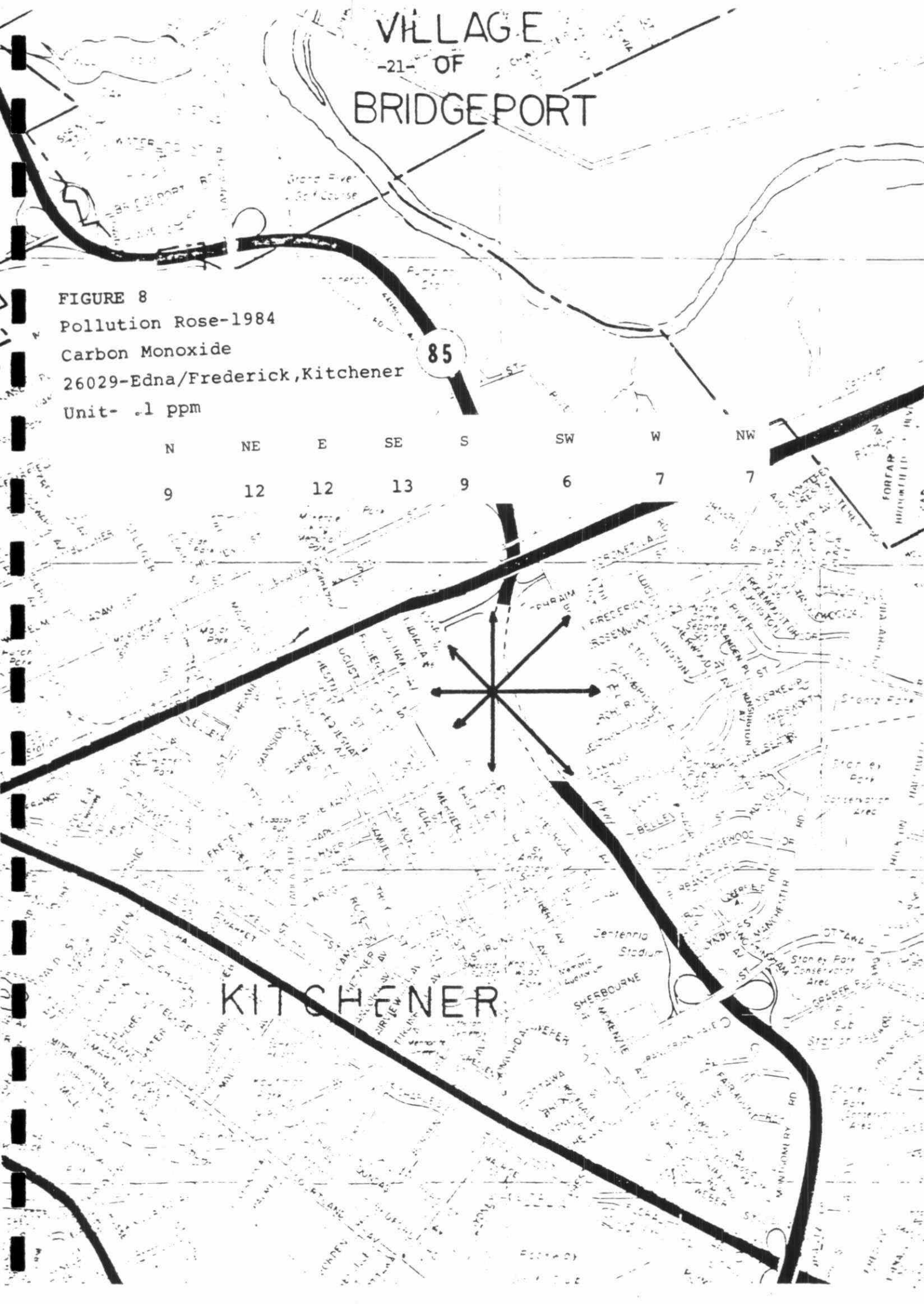


FIGURE 8
Pollution Rose-1984
Carbon Monoxide
26029-Edna/Frederick,Kitchener
Unit- .1 ppm

N	NE	E	SE	S	SW	W	NW
9	12	12	13	9	6	7	7

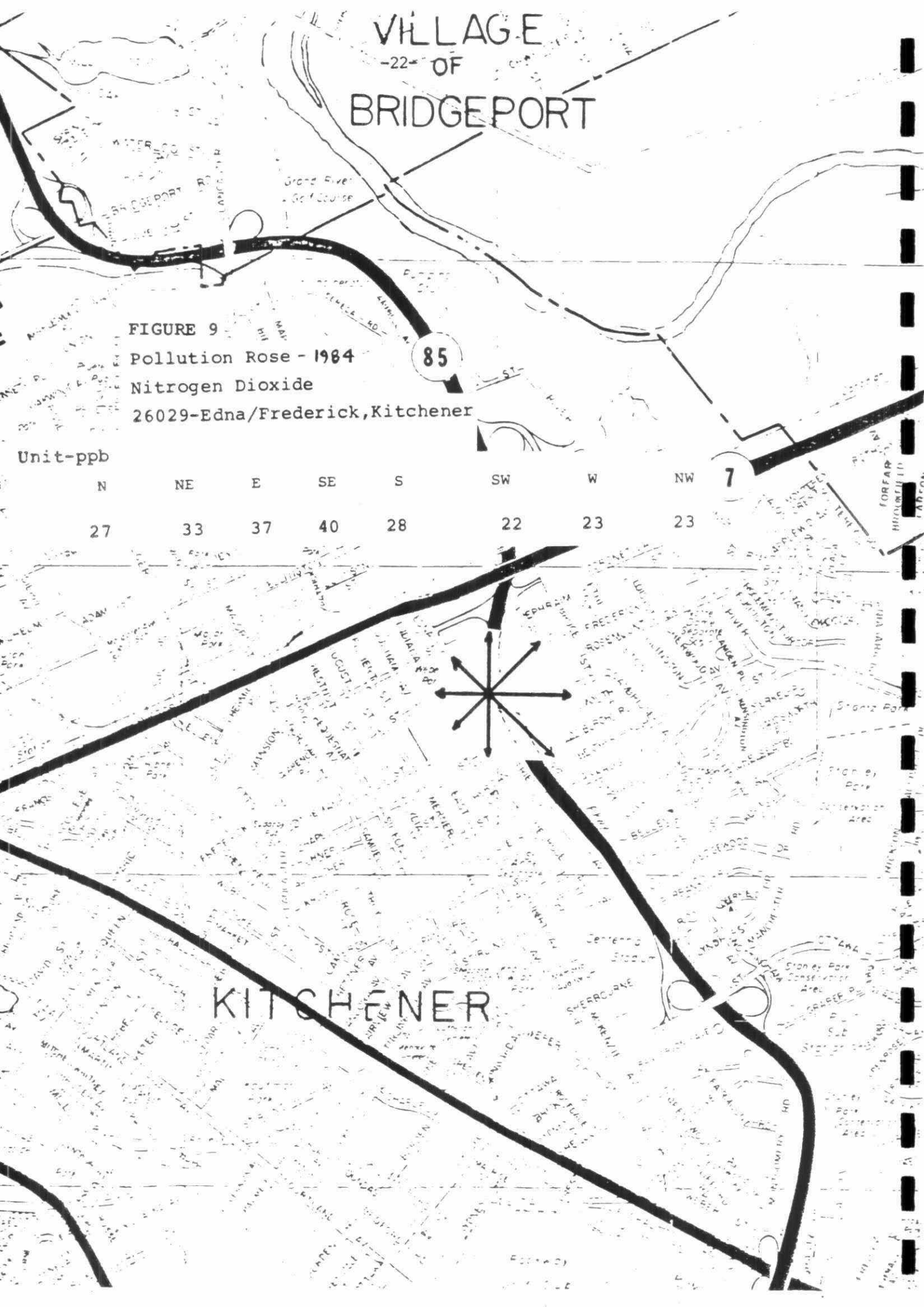


FIGURE 9
Pollution Rose - 1984
Nitrogen Dioxide
26029-Edna/Frederick,Kitchener

Unit-ppb

N	NE	E	SE	S	SW	W	NW
27	33	37	40	28	22	23	23

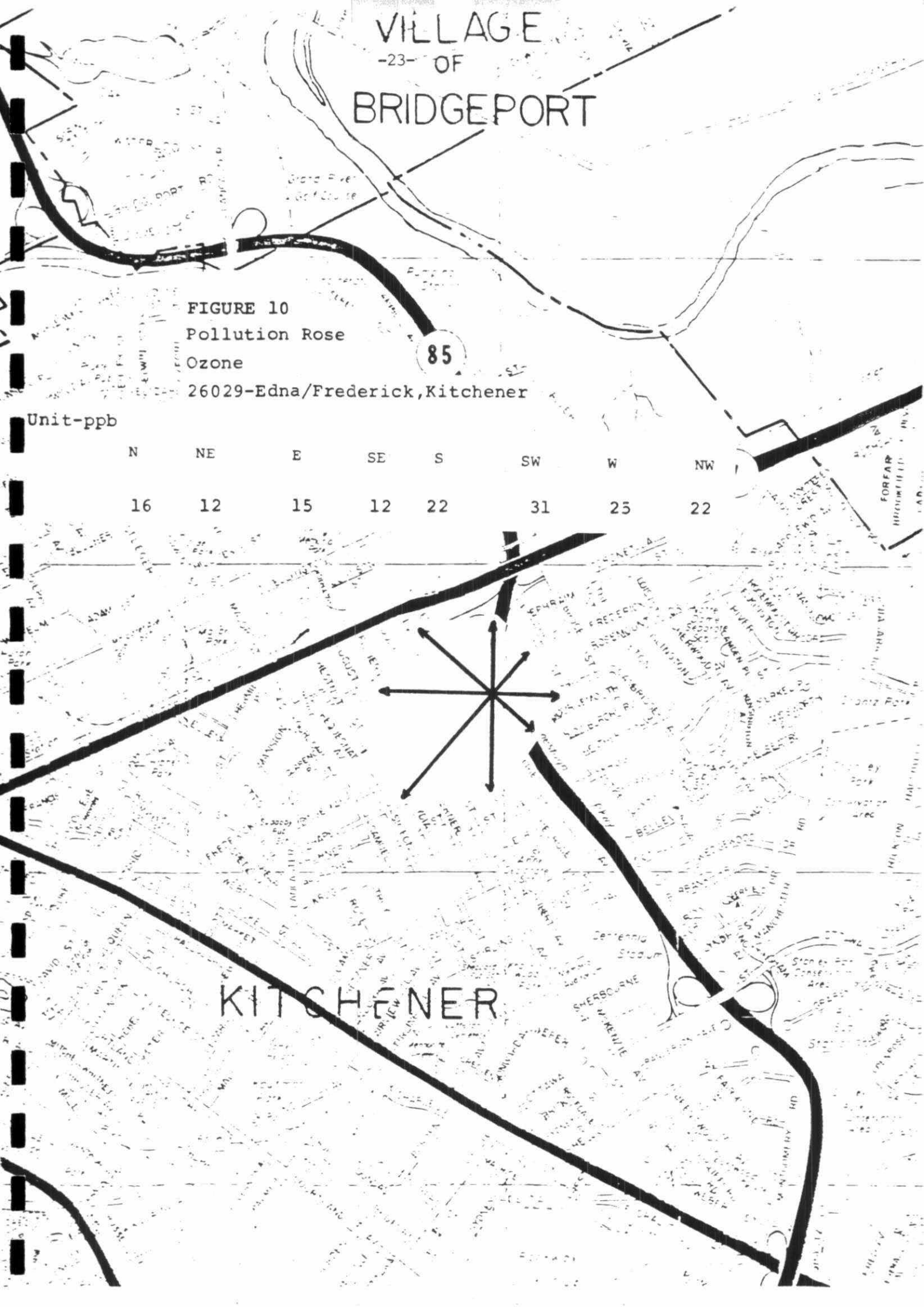


FIGURE 10
Pollution Rose
Ozone
26029-Edna/Frederick,Kitchener

Unit-ppb

N	NE	E	SE	S	SW	W	NW
16	12	15	12	22	31	25	22

TABLE 1
SULPHUR DIOXIDE
UNIT - PARTS PER MILLION

Ontario Objectives: 1-Hour - .25
24-Hour - .10
1-Year - .02

LOCATION	ANNUAL AVERAGE 1984	1983	1982	1984 MAXIMUM 1-Hour	24-Hour	NO. OF TIMES ABOVE OBJECTIVE (1984) 1-Hour	24-Hour	SOURCE MONITORED
26029 Edna/Frederick Kitchener	.003	.002	.003	.09	.05	0	0	General Ambient
28025 Farquhar/Wyndham Guelph	.002	.003	.003	.15	.04	0	0	General Ambient

TABLE 2
OZONE
UNIT - PARTS PER BILLION

Ontario Objective: 1-Hour - 80

LOCATION	ANNUAL AVERAGE 1984	1983	1982	1984 MAXIMUM 1-Hour	NO. OF HOURS ABOVE OBJECTIVE (1984)	SOURCE MONITORED
26029 Edna/Frederick Kitchener	18.3	18.9	17.8	90	6	General Ambient

TABLE 3
CARBON MONOXIDE
UNIT - PARTS PER MILLION

Ontario Objectives: 1-Hour - 30
8-Hour - 13

LOCATION	ANNUAL AVERAGE 1984	1983	1982	1984 MAXIMUM 1-Hour	8-Hour	NO. OF TIMES OVER OBJECTIVE (1984) 1-Hour	8-Hour	SOURCE MONITORED
26029 Edna/Frederick Kitchener	.9	1.0	1.0	10	5	0	0	General Ambient

TABLE 4
NITROGEN DIOXIDE
UNIT - PARTS PER MILLION

Ontario Objectives: 1-Hour - .20
24-Hour - .10

LOCATION	ANNUAL AVERAGE 1984	1983	1982	1984 MAXIMUM 1-Hour	24-Hour	NO. OF TIMES ABOVE OBJECTIVE (1984) 1-Hour	24-Hour	SOURCE MONITORED
26029 Edna/Frederick Kitchener	.027	.025	.028	.10	.06	0	0	General Ambient

TABLE 5
SUSPENDED PARTICULATES
UNIT - MICROGRAMS PER CUBIC METRE

Ontario Objective: 24-Hour - 120
1-Year Geo. Mean - 60

LOCATION	GEOMETRIC MEAN 1984	1983	1982	1984 MAXIMUM	% OF SAMPLES OVER 120 (1984)	SOURCE MONITORED
28025 Farquhar/Wyndham Guelph	40	35	38	151	2%	General Ambient
28027 Sewage TR. Plant Guelph	63	51	72^{7}	291	16%	Dolime
26029 Edna/Frederick Kitchener	58	51	54	148	5%	General Ambient

7 - Exponent refers to number of months sampled when less than 12.

TABLE 6
DUSTFALL
UNIT - GRAMS/SQUARE METRE/30 DAYS

Ontario Objectives: 1-Month - 7.0
1-Year - 4.5

LOCATION	ANNUAL AVERAGE 1984	1983	1982	1984 MAXIMUM 1-Month	NO. OF MONTHS ABOVE OBJECTIVE (1984)	SOURCE MONITORED
26026 Stanley Street Ayr	19.9	19.7	16.5^{10}	36.0	11	Date Industrie Foundry
21010 Ruth Street Brantford	6.1	6.0	6.7	15.2	4	Massey-Ferguson FDRY
21011 Harriet Street Brantford	4.6	4.3	4.1^{11}	13.2	2	Massey-Ferguson FDRY
21013 Henry Street Brantford	6.2	-	5.6	13.0	3	Witco Chemicals
21016 West Street Brantford	5.8	5.5	4.7	11.5	3	Bell City Foundry
26036 Fountain Road Breslau	8.6	6.9	7.0	13.3	9	Breslube
26040 Guelph Avenue Kitchener	6.2^{11}	6.8^{10}	7.7	13.3	6	Hogg Fuel and Supply

10 - Numerical exponent refers to number of valid monthly samples when less than 12.